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## (54) HANDLING OF INVALID PATIENTS

(71) I, PETRUS LODEWYKUS BOTHA, a South African citizen of 168 Rietfontein Road, Primrose, Germiston, Transvaal Province, South Africa, do hereby declare the invention for which I pray that a Patent may be granted to me and the method by which it is to be performed to be particularly described in and by the following statement:—

10 THIS INVENTION relates to an apparatus for handling an invalid patient.

According to the invention an apparatus is provided for handling an invalid patient which includes a supporting structure comprising a portal frame having a pair of spaced and extendible and retractable posts and a longitudinal member supported on the ends of the posts, a pair of spaced horizontal rollers substantially parallel with the longitudinal member and journaled on cross members mounted on the longitudinal member, at least one endless sling supported on the rollers and rotatable by applying rotary motion to the rollers whereby a patient located within the sling is rotatable about a longitudinal axis, and on upward extension of the posts the patient may become suspended in the sling.

The endless sling or each endless sling should be of a suitable strong and flexible material, such as for example a canvas sheet, and is supported in such a way that it forms a downwardly extending loop in which the patient is to be supported. Advantageously the sling comprises an elongated rectangular sheet of suitable material of which the transverse ends are connectable and disconnectable. When said transverse ends are connected the sheet forms the endless sling. When disconnected the sheet may remain across the bed of the patient while the rest of the apparatus may be removed.

The means for raising and lowering the sling may be mechanically operable, for ex-

ample by means of a gear and screw arrangement. Preferably the said raising and lowering is by an hydraulic or like system.

The apparatus according to one form of construction includes a piston and cylinder means in which the piston is displaceable hydraulically or pneumatically. One or more piston and cylinder units are preferably provided and adapted for simultaneous, separate or uneven operation.

A piston and cylinder unit is conveniently incorporated with each post of the supporting structure for upward extension of the posts hydraulically or pneumatically by means of a manually, mechanically or electrically operated pump adapted for generating fluid pressure. A reservoir for the operating fluid is also provided. Such reservoir may be incorporated in the longitudinal member of the supporting structure. For such purpose the longitudinal member is advantageously hollow and suitably adapted.

The apparatus according to the invention may be fixed to a bed of a patient by suitable fixing means, such as clamps. Alternatively the apparatus may be mounted on bases having casters for mobility.

With one or each roller for each sling a hand wheel or crank may be provided for rotation of the roller or rollers and consequent rotation of the sling. Each roller is preferably provided with a circumferential encasement of a material having a high coefficient of friction with the material of the sling, e.g. rubber, to facilitate the rotational movement of the sling.

For the invention to be clearly understood and carried into effect reference will now be made to the accompanying sheets of drawings which illustrates, by way of example, apparatus according to the invention.

In the drawings:—

Figure 1 is a diagrammatic side view of an apparatus constructed according to the

invention and adapted for clamping in position on a bed;

Figure 2 is a diagrammatic side view of a self supported apparatus, also according to the invention;

Figure 3 is a fragmentary isometric view of a portion of the apparatus having the means for engaging the patient;

Figure 4 is a fragmentary side elevation, drawn to a larger scale, of an hydraulic raising and lowering system incorporated in the apparatus as shown in Figures 1 and 2;

Figure 5 is an end elevation of Figure 4; and

Figure 6 is a flow diagram of the hydraulic system.

In the drawings reference numeral 10 generally denotes the portion of the structure whereby the handling of the patient is effected. This portion of the apparatus comprises a beam 12 having spaced cross members 14 in the form of transverse beams or brackets fixed to the beam 12. Each pair of transverse beams 14 are provided with inline notches 16 adjacent the ends for receiving stub axles 18 for rollers 20. Over each pair of rollers 20 an endless sling 22 is passed so that the sling is capable of being moved in rotation fashion. The stub axles are journaled in the notches 16 and are readily removable therefrom.

At the ends of the beam 12 downwardly directed rigid brackets 24 are secured. In each bracket 24 a hole is provided for receiving a bolt 26 and whereby each end of the beam 12 is pivotally connected to the top end of a piston 28 of piston and cylinder units 30, 30.1.

In Figure 1 the piston and cylinder units are clamped by clamping brackets 32 to the end frames 34 of a bed 36. In this figure the two slings 22 are shown in chain dotted lines as extending across and with end portions hanging from the bed 36 when they are not in use. Each sling 12 comprises a rectangular shaped sheet of flexible material of which transverse edges are connectable by suitable means. When not in use the slings 22 may be tucked in under the mattress of the bed 36. In Figure 1 the portion 10 of the structure is shown by broken lines in the lowered position while in the said figure the raised position of the structural portion 10 and the slings 22 are shown in full lines.

The two slings are of different sizes. The body of a patient is required to be suspended in the larger sling, and the legs of the patient in the smaller sling.

In Figure 2, which shows a movable or mobile apparatus, the apparatus is shown in the operative position over a bed 36. The apparatus is provided with bases 38, which have casters 40. In this mobile form of the

apparatus the piston and cylinder units 30, 30.1, for raising and lowering of the structure 10, are incorporated in or form the upper portions of posts 42 extending from the bases 38.

Also mounted on cylinder unit 30.1 are a pair of plunger pumps 44, 44.1 for generating fluid pressure. The pumps 44, 44.1 are manually operated by a hand lever 46. The outlets and the pistons of the pumps are provided with unidirectional valves. The plunger rods extend from the top of the pump cylinders 44, 44.1 and are coupled to an intermediate portion of the hand lever 46. The outlets of the pumps are in the bottom of the cylinders while intermediately of the upper and lower ends ports with conduit connectors 48 are provided. The connector 48 and a connector 50 at the outlet of each pump 44 and 44.1 are connected to opposite ends of stop valves 52 and 52.1 (see Figure 6). The stop valves 52 and 52.1 are manually controlled. Said connector 50 of pump 44 is connected by conduit 54 to the bottom end of piston and cylinder unit 30 while connector 50 of pump 44.1 is connected to the bottom end of piston and cylinder unit 30.1. Intermediate portions of the cylinders of the units 30, 30.1 are connected to a reservoir for the hydraulic fluid by flexible pressure conduits 60. The beam 12 is constructed to form the reservoir and comprises a totally enclosed hollow box section elongated member having a sump-like portion 56. The connectors 48 of both pumps 44, 44.1 are connected by conduits 58 to the sump portion 56. The conduit 54 to the distant unit 30 may be taken interiorly along the beam 12 while the conduits 60 from the intermediate portions of the units 30, 30.1 are connected to the ends of the reservoir forming beam 12.

An orthopaedic traction unit 62 can be mounted on the portion 10 of the structure, as is shown in Figure 2, for use by patients having leg fractures requiring the use of such unit.

On operation of the pumps 44, 44.1 and when the valves 52, 52.1 are closed the working fluid is passed along the pressure conduits 54 to the piston and cylinder units 30, 30.1 and as a result of which the pistons are extended upwardly. When the pistons reach the positions of the connectors for conduits 60 of the units 30, 30.1, the maximum height of the beam and the parts carried thereby is reached. Due to the unidirectional valves in the outlets of the pumps lowering of the portion 10 of the structure is prevented or is considerably retarded should said valves leak. On opening of the valve 52, 52.1 the weight of the beam 12 and parts carried thereby, and of the patient, causes return flow of the fluid through the conduits 54 for the lowering action. The

return flow is to the reservoir through the valves 52, 52.1. The extent of opening of the valves 52, 52.1 controls the rate of lowering. On opening one valve to a greater extent than the other the raising and lowering of the beam 12 may be at an inclination should this be desired.

When the apparatus is not in use the slings 22 are disconnected to drape over the patient's bed as shown in Figure 1 while the patient lies on top of them. When required for use the slings are passed over the respective pairs of rollers 20 and their ends are connected to form the required endless slings. The patient is supported in the slings 22 as the beam 12 is raised to the required height by operation of the lever 46 of the pumps 44, 44.1. The bed of the patient can then be made or rearranged.

If it is required to turn the patient around this may be effected in the raised position of the portion 10 of the structure and slings 22 and when the slings 22 are caused to rotate over the rollers 20. The rotating movement is applied to the rollers by means of crank handles 64 and/or hand wheels 64.1 which are fixed to end portions of the axles 18 of the rollers. When the patient is turned over the back of the patient can then be attended to or treated. Although one roller of each pair is shown having a hand wheel and the other a crank handle, both rollers or only one of a pair of rollers may be provided with such hand wheel 64.1 or crank handle 64.

Portions of the conduits 54, 58 and 60 must consist of flexible pressure tubing to provide for the relative movement of the structure portion 10 and parts carried thereby, and the stationary pumps 44, 44.1 and valves 52, 52.1.

#### WHAT I CLAIM IS:—

1. An apparatus for handling an invalid patient which includes a supporting structure comprising a portal frame having a pair of extendible and retractable spaced posts and a longitudinal member supported on the ends of the posts, a pair of spaced horizontal rollers substantially parallel with the longitudinal member and journaled on cross members mounted on the longitudinal member, at least one endless sling supported on the rollers and rotatable by applying rotary motion to the rollers, whereby a patient located within the sling is rotatable about a longitudinal axis, and on upward extension of the posts, the patient may become suspended in the sling.
2. An apparatus as claimed in claim 1 wherein the or each sling comprises a strong and flexible material sheet suspended from a pair of laterally spaced rollers rotatably supported at parallel spaced positions on opposite sides of the longitudinal member,

said sling being suspended from the rollers to form a downwardly extending loop wherein the patient is supported.

3. An apparatus as claimed in claim 2 wherein the sling comprises a rectangular flexible sheet material element having detachable ends which, when connected, permits the formation of the endless sling and, when detached, becomes dissociated from the rollers and support structure.

4. An apparatus as claimed in any claim 1, 2, or 3 wherein at least one of the rollers for the or each sling is provided with means to apply a rotating action thereto and to cause the rotation of the endless sling.

5. An apparatus as claimed in any one of claims 1 to 4 wherein at least two slings and co-acting pairs of rollers are carried by the longitudinal member in adjacent end to end relationship.

6. An apparatus as claimed in claim 5 wherein the loops of the slings are of different sizes while the spacing of the rollers for one of the slings is greater or smaller than that for the adjacent sling.

7. An apparatus as claimed in any one of claims 1 to 6 wherein the rollers are readily removable from the cross members of the support structure.

8. An apparatus as claimed in any one of claims 1 to 7 wherein the rollers are provided with a circumferential surface having a high co-efficient of friction with the material of the sling.

9. An apparatus as claimed in any one of claims 1 to 8 wherein end portions of the longitudinal member are provided with brackets adapted for coupling to raising and lowering parts of the posts.

10. An apparatus as claimed in any one of claims 1 to 9 wherein mechanical means are provided for raising and lowering the longitudinal member and parts supported thereby.

11. An apparatus as claimed in any one of claims 1 to 9 wherein a fluid pressure system is employed for raising and lowering of the longitudinal member and parts supported thereby.

12. An apparatus as claimed in claim 11 wherein a hydraulic system is employed for raising and lowering of the longitudinal member and parts supported thereby, said system having cylinder and piston units included in the posts, a pump for forcible transference of a working fluid of the system to the cylinders of the units for raising of the longitudinal member and parts supported thereon, and valves to control the lowering of the longitudinal member and parts supported thereby.

13. An apparatus as claimed in claim 12 wherein two piston and cylinder units are incorporated in the working fluid system which are capable of simultaneous, separate

or uneven operation.

14. An apparatus as claimed in claim 13 wherein the pistons are upwardly displaceable and to the top ends of which the longitudinal member is pivotally connected.

15. An apparatus as claimed in any one of claims 1 to 9 wherein a hydraulic system is employed for raising and lowering of the longitudinal member and the parts supported thereby, said system including a cylinder and piston unit incorporated in each post, a pivot connection between an upwardly projecting extendible part of each piston and cylinder unit and an end of the longitudinal member, a pump embodiment comprising two similar single action pumps operated by a single hand lever, separate conduits and hand operated control valves connecting one pump to one piston and cylinder unit and the other pump to the other piston and cylinder unit while both units are connected to a common reservoir whereby the cylinder and piston units may be

extended or retracted simultaneously, separately or unevenly.

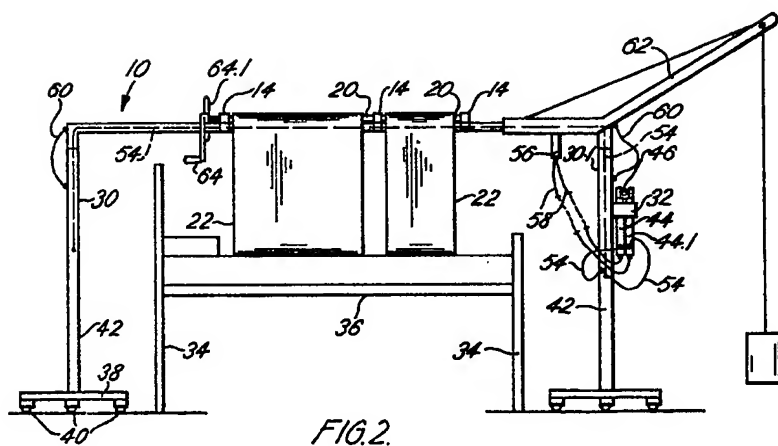
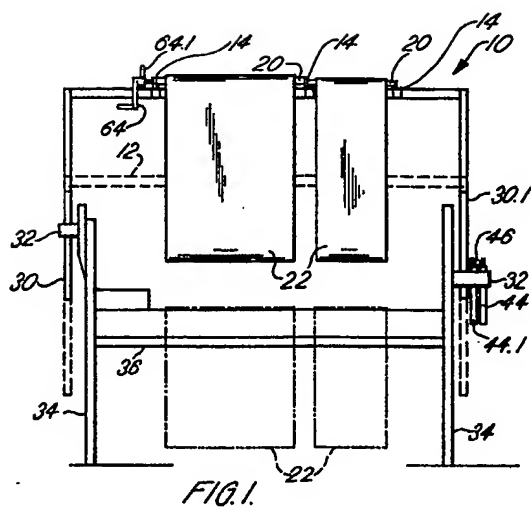
16. An apparatus as claimed in claim 15 wherein the longitudinal member is in the form of a totally enclosed hollow beam and adapted to form the reservoir for the working fluid.

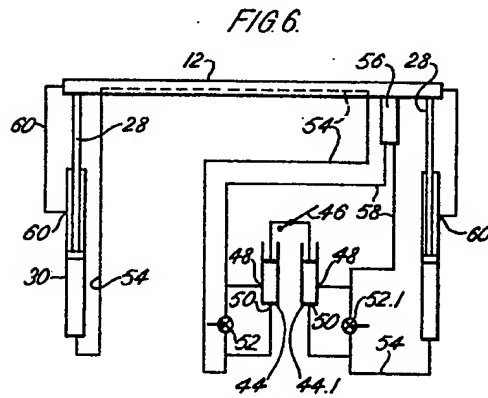
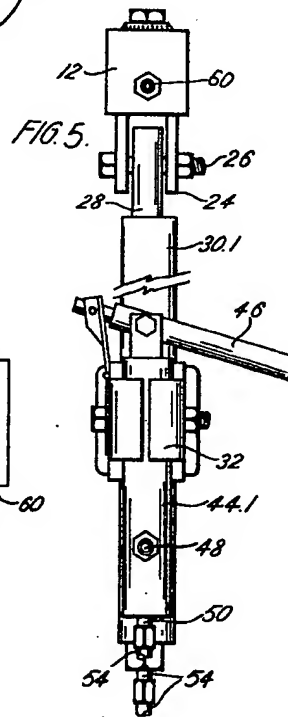
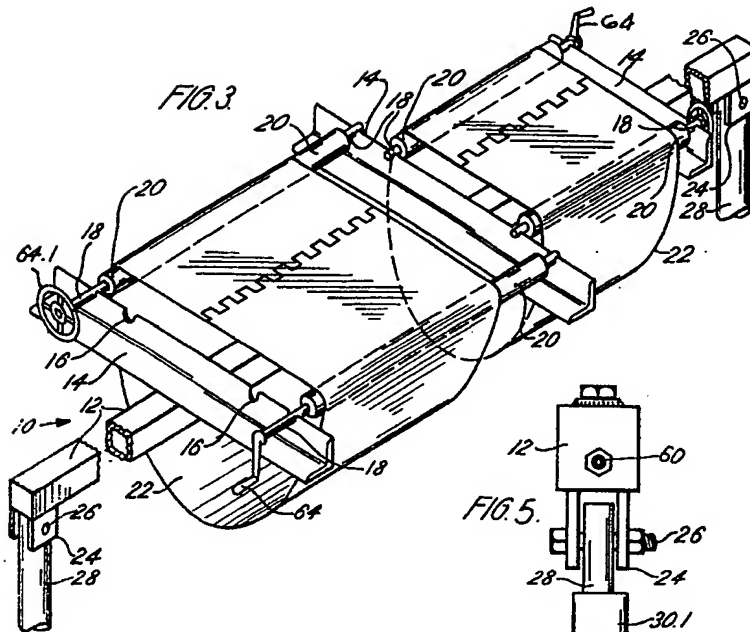
17. An apparatus as claimed in any one of claims 1 to 16 wherein the posts are connectible to the opposite ends of a bed.

18. An apparatus as claimed in any one of claims 1 to 16 mounted on movable base means.

19. An apparatus for handling an invalid patient substantially as hereinbefore described and illustrated in the drawings.

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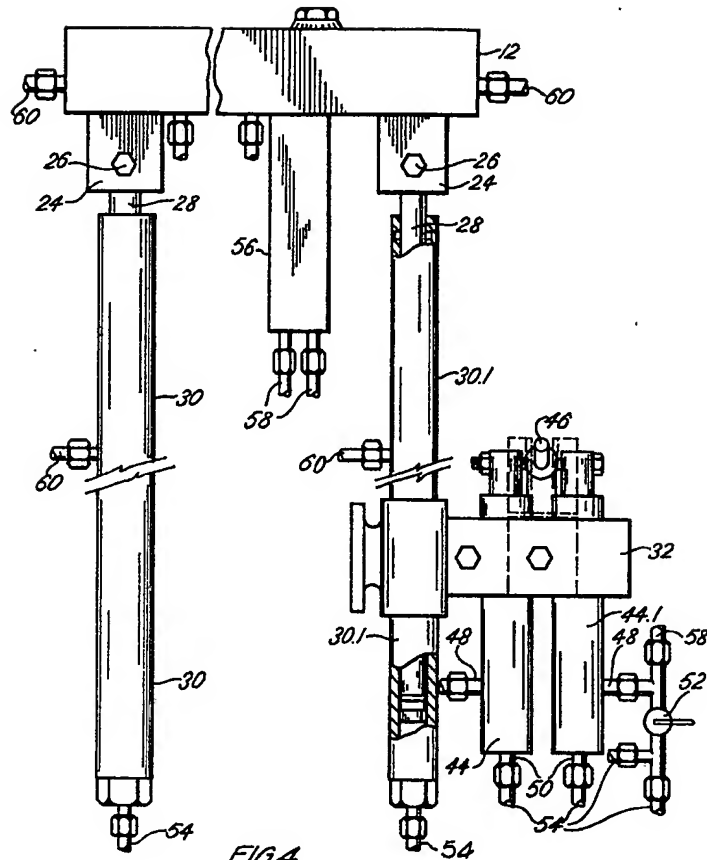


FIG. 4.